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XVII.—*Notice of the British Earthquake of November 9, 1852.* By ROBERT MALLEY, C. E., M. R. I. A.

Read February 13, 1854.

ALTHOUGH earthquakes are recorded as occurring in very considerable numbers in Great Britain, yet their effects have usually been so slight and transient, that a new one is always an object of popular interest, though, fortunately, from these circumstances, of no more abiding importance generally. For objects beyond merely learned curiosity, as aiding in the compilation of that base of induction that is yet destined to make the earthquake part of exact science, it seemed desirable to collect and arrange, in as authentic and clear a form as the author found possible, the facts of the earthquake of 1852,—one of the most widely diffused and simultaneously felt shocks of any recorded as affecting our islands.

For this purpose, shortly after the occurrence, the author published in several newspapers an invitation to all observers of the earthquake to forward to our fellow-labourer, Mr. Edward Clibborn, on his behalf, communications as to such facts as they might be in possession of respecting the event, and accompanied his invitation by the statement of the four most important points of fact to which attention was principally desirable.

He also applied officially to the heads of the Dublin Metropolitan Police, requesting a systematic examination of the men on duty on the night of November 9, 1852, and that their answers to certain questions given, should be transmitted back to him.

The author, with regret, deems it due to science to mention, that the leading London journal to which he transmitted his request for English communications, with an apathy or ignorance scarcely credible, declined publishing it.

The police authorities promptly answered the author's desire, and the testimony of the police on duty having been taken by one of the inspectors, they forwarded to him documents of which the following embraces the sum.

1. A great number of the police observed a shock.
2. Several of the men state that the motion was sideways, others that it was up and down. They are also divided in opinion as to whether it was from east to west, or from north to south.
3. All agree in stating that the time was two or three minutes before or after 4 o'clock, A.M.
4. All heard a rumbling noise, somewhat like distant thunder ; they also heard a rattling of windows as if shaken by a concussion.

The result proves how little reliance as to accuracy or amount of information is to be expected from persons untrained in habits of exact and faithful observation.

Through the zealous co-operation of Mr. Clibborn, a very large number of private letters and other communications were received, and many others, as well as newspaper notices, were transmitted directly to the author. The great mass of these, however, were liable to the remarks just before made. A very few, selected for their graphic character, were sufficient to read to the Academy, though not to publish *in extenso*. All that appeared worthy of credit for accuracy, &c., were arranged and discussed in the form following, very much upon the model of the Great Earthquake Catalogue of the Transactions of the British Association ; and from the combination of information from all sources the Seismic map accompanying this paper was prepared. Upon it all places at which a record exists of the shock having been felt are marked in red letters. Wherever the time of the occurrence of the shock was noted it is marked after the name of the place of observation. The time in Ireland is assumed as that for the meridian of Dublin ; that in Great Britain is, with one exception (Congleton), Greenwich mean time. Wherever the horizontal direction was noted, it is marked by a red arrow passing through the place in that direction. The broad shaded line generally circumscribes the space within which the shock is recorded to have been actually felt, or may be inferred that it might have been felt. But it will be understood that such a boundary is wholly imaginary, and serves merely to convey a general notion of the form of the territory shaken, as the motion due to the earth-wave (like all other elastic waves in media of indefinite dimensions) passes away from the point of

greatest disturbance or summit of the wave, and is gradually lost in all directions to observation, whether unaided or instrumental. Were our earth perfectly elastic, in fact every earthquake, however slight, would shake the whole globe.

The author's own experience at Glasnevin, near Dublin, was that of being suddenly aroused from sound sleep, with some slight sense of alarm by, as it seemed to him, a tremulous shock, with a dead, heavy, thump-like sound, such as a very heavy bag of wet sand might make if dropped from some feet above, upon a large planked floor; his immediate thought was, that some heavy man had jumped upon the floor of the room beneath his bedroom; and conceiving the possibility of house-breakers, he looked out of the window and listened attentively for a few seconds. Not a sound disturbed the singular stillness of the dull, dark-gray leaden haze that hung over the winter morning; he fancied his wife must have started in sleep, and returned directly to bed again. The notion of an earthquake never occurred to him, and it was not until its occurrence was remarked to him by others at noon, that he connected his disturbance with such an event. Several families residing in the author's neighbourhood, however, were so much alarmed by the disturbance (more particularly in a few instances where some of the members had been familiar with earthquakes abroad, and at once recognised this as one), that they remained up all the rest of the night, or rather early morning.

On arriving in town he found a large framed drawing of 4 feet 9 inches long, by 2 feet 7 inches deep, and weighing about 7 lbs., which had hung by two brass rings attached by leather straps to the frame against a wall of his office, ranging S. by W. and E. by N. fallen down and wedged diagonally in its own plane between two walls which started at right angles from the wall against which it hung, and at an interval not much wider than the breadth of the framed drawing. The leather straps of the rings were torn asunder, and on examination proved to have been a little decayed by age and drought; but the leather, on trial, was still found to possess such toughness that a weight much beyond that of the drawing and frame would have been incapable of rending either of them.

The author made these observations before the occurrence of an earthquake had been noticed to him; he afterwards returned to the matter and carefully observed the conditions in which the drawing hung, and under which it was found fallen. Of this, more hereafter.

BRITISH EARTHQUAKE OF NOVEMBER 9, 1852.

SCOTLAND, ENGLAND, AND WALES.

LOCALITY.	APPARENT DIRECTION.	SHOCKS, NUMBER.	DURATION AND TIME.	OBSERVED PHENOMENA.	AUTHORITY.
Glasgow,		One or more.		A lady awaked by shaking of her bed.	Correspondent of North British Mail, November 16, 1852.
Ramsay,		One.	A few seconds; 4 15 A.M.	Awakened by noise as of house-breakers; shook every house in the place; weather for some days before wet and boisterous.	Correspondent of the Times, November 13, 1852.
Harrogate,		One.	4 A.M.	Numbers roused from sleep; windows, doors, and movables violently shaken; dogs barked.	Correspondent of Times, November 13, 1852.
Southport,		One.	Some seconds;	Beds shaken, doors rattled, &c.	Saunders' Newsletter, November 13, 1852.
Lytham,		One.	4 30 A.M.	A lady awakened at 4½ A.M. Then recollected having felt something of the sort before earlier in the same night.	Liverpool papers quoted by Times, November 10, 1852.
Fleetwood,		One or more.	4 30 A.M.	Furniture shaken; a strong oscillation of the ground and buildings; a deep rumbling noise distinctly heard by many persons; children screamed when awakened. One observer felt five or six vibrations; day dark and misty, with drizzling rain.	
Liverpool,		One.	4 30 A.M.		
Manchester,	North and South, or N. E. & S. W.	One.	From 3 or 4 to 30 seconds. 4 30 A.M.	A tremulous vibratory motion, like that of the rolling of many waggons; furniture seen to move; several persons experienced nausea; dogs trembled and were much frightened; no noise was heard but that produced by movables shaken. The shock considered by those who felt it both more violent than that of March, 1843; temperature at the time about 50° Fahr. The morning very dark, but calm and fair.	Correspondent of Saunders' Newsletter, November 11, 1852.
Holyhead,		One.	4 30 A.M.	A shock felt, accompanied by a very loud noise; wind S. E.; cloudy.	Correspondent of Times, November 10, 1852.
Beaumaris,	S. to N., or 10° to 15° W. of N.	One.	While counting rapidly 100; 20 to 30 seconds.	Large things, that required an effort to shake by hand, shook audibly in bed-room; a noise before, during, and after, heard by several.	Andrew Ramsay, Esq., Geological Survey, Beaumaris; private letter, November 9, 1852.
Bangor,		One.	4 30 A.M.	A shock accompanied by a very loud noise; wind S. E.; fog.	Electric Telegraph to Times, November 10, 1852.
Caernarvon,	S. and N.	A continued vibration.	20 or 30 seconds; time not given.	A fearful rolling noise, like a whole brigade of fire-engines running over a paved street, suddenly broke an oppressively calm morning, it died gradually away; everything shook.	Evening Post, November 13, 1852, copied probably from a Manchester paper.
Llanberis,		One.	4 30.	A tremendous blow; slates clattered on the roof, and everything shook; a rumbling sound, which seemed to travel away into distance.	Rev. R. Eyre; letter in Western Star, November 12, 1852.
Gifach, in Wales,	W. to E. (?); oscillatory.	Continued vibration about 60 seconds.	4 30.	A hollow noise like distant thunder, coming and going from N. W. to S. E.; a trembling increasing to a rapid rocking.	A mining captain's letter in Saunders, November 13, 1852.
Congleton,		One.	4 A.M.	A smart shock.	Electric Telegraph to the Times, November 10, 1852.
Birmingham,			4 30 A.M.	In Birmingham felt but slightly; noise and shock both perceived.	
Cheadle and various places in Staffordshire,				At Cheadle, seemed to most persons like the shock and noise of a heavy person falling out of bed. At Barnage the sound was like that of a rushing wind; some evidence of a previous shock on the night of the 8th of November, at 10½ P. M.	

SCOTLAND, ENGLAND, AND WALES—continued.

LOCALITY.	APPARENT DIRECTION.	SHOCKS, NUMBER.	DURATION AND TIME.	OBSERVED PHENOMENA.	AUTHORITY.
Shropshire, Shrewsbury, Iron Bridge, Bromley, &c.	W. S. W. and N. N. E.	Three or four.	4 30 A.M.	A severe shock felt all over the county, getting fainter to the westward; pheasants crowed at Acton Reynal preserves; sleepers awakened; doors rattled; houses shook bodily.	Mr. Clibborn, M.R.I.A. private communication. Belfast Mercury, November 12, 1852.
Wolverhampton,	.....	At Fitz the shock lasted 30 seconds, according to Rev. D. Nihil.	.....	The weather had been wild and stormy, with lightning and hail, some days before, but was quite calm at the time; no sound was observed; bells rung at Ellesmere church; at Newton a wood bridge over the Severn thrown down; 30 yards of strong wall thrown down at Shrewsbury.	
Haverfordwest,	.....	One.	.....	A severe shock; blowing and hailing before; many people up and awake.	
Gloucester and Bristol,	.....	.....	.....	Stated to have been felt plainly in both.	

IRELAND.

LOCALITY.	APPARENT DIRECTION.	SHOCKS, NUMBER.	DURATION AND TIME.	OBSERVED PHENOMENA.	AUTHORITY.
Co. Antrim,		One.	4 30 A.M.	The shock distinctly felt in several parts of the country.	Coleraine Chronicle, November 14, in Saunders' Newsletter, November 15, 1852.
Armagh City,				Noticed by two persons.	Private communication from Dr. Robinson, November 10, 1852.
Belfast,	Probably from South to North.	One.	Shortly after 4 o'clock.	Undoubtedly felt, accompanied by a dull, heavy sound; houses shaken; the motion vibratory; thirty printers at work in the Belfast newspaper offices were not conscious of the shock.	Belfast Mercury, November 11, 1852.
Newtownards,		One.	.....	A person awakened by oscillation of his bed, and noise of the window bars of his bed-room.	Belfast Mercury.
Tandragee,		Two within a few seconds.	4 A.M.	The whole room shook twice; furniture creaked and was displaced; the observer was awake and reading.	Saunders' Newsletter, November 10, 1852.
Glaslough,		Two.	4 10, or 4 12 A.M.	The bed of the observer was twice heaved up as if by a large dog turning nimbly underneath, the second heave shorter than the first; all in the house felt it and got up from bed and assembled at once.	Correspondent of Saunders' Newsletter, November 12, 1852.
Carlingford,		One, lasting 15 seconds.	4 8 A.M.	Every movable article set in motion from top to bottom of the house; many of the family did not awaken; great terror produced.	P. Darcy, correspondent of the Evening Post, November 13, 1852.
Newry,		One.	.....	Experienced with great alarm by many individuals while in bed.	Newry Telegraph and Saunders of November 12, 1852.
Balbriggan, the Naul, Swords, Ardgillan Castle,		One.	.....	Houses shook at Swords; felt very intensely at the Naul; the family awakened at Ardgillan Castle, and the steward fired a gun out of the window, fancying he heard housebreakers.	Saunders' Newsletter, November 11, 1852.

IRELAND—continued.

LOCALITY.	APPARENT DIRECTION.	SHOCKS, NUMBER.	DURATION AND TIME.	OBSERVED PHENOMENA.	AUTHORITY.
Dublin City,	S. to N. or S. E. by S. and N. W. by N. A telescope standing on end fell towards the north in Nassau-st.— <i>G. Yeates.</i> A picture was shaken down from its fastenings on a wall runing S. by W., and N. by E., and so circumstanced as to prove that the direction of emergence of shock was upwards at a considerable angle from S. to N.— <i>R. Mallet.</i>	One, and probably one at a previous part of the night. It seems very probable that there was a previous shock on the night of the 9th of Nov. at about 12 o'clock, and some likelihood of another or several minor ones having been felt on the night of the 11th November, 1852. (<i>Letters from Mr. Clibborn and Mr. Malone.</i>) Some observers were conscious of three distinct heaves during the continuance of the tremor. (<i>Letter, I. Farrell, Gt. Brunswick-street.</i>)	4 to 4 15 A.M. Most probably at 4 5 Dublin time. Whole time of tremor about 8 or 10 seconds.	The shock perceived by multitudes both awake and suddenly aroused by it from sleep; those who were awake and standing, or in motion, felt little; those who leaned against walls or other objects were fully alive to the reality and extent of the motion. Observers who were awake differ as to accompanying noise, but evidence for its occurrence preponderates. The sound is variously described as of "a rushing wind," a "rumbling sound like a fire-engine on pavement," &c. Almost all sleepers suddenly aroused by the shock were conscious of a heavy, hollow sound, like the fall of a heavy soft body on a large hollow floor. The motion is generally described as vibratory, ending in one or two sudden heaves. It is uncertain whether the sound accompanied or closely succeeded the shock; most probably the latter. Houses were heavily shaken; a shattered chimney thrown down at Phibsborough; water thrown out of full vessels. A few minutes after the shock, the street gas-lights were observed to be agitated as in a storm, arising obviously from the agitation of the water in the gasometer tanks at the works. (<i>Letter from Mr. Wilson, Christ-Church-place.</i>) The balance-weights of window-sashes swung against the sash-casings, north side of Dublin. Sparrows were thrown from their roosting-places, Great Southern and Western Railway goods shed, and Mountjoy-square, and many picked up dead on the ground in the morning. Watchmen at the Dublin and Drogheda Railway terminus saw the drag-chains hanging from trucks set to oscillate. Caged birds in some instances began to sing; dogs barked; the printers at work in Saunders' News Office were unconscious of anything unusual. Chairs standing on an oilcloth floor in Lincoln-place slid along the floor out from the wall. The night of the 9th was oppressive and sultry for the time of year; a leaden sky, more than usually light for the time and season, obscuring all stars, and a death-like calm. A few drops of rain fell in some places. Passengers in the Liverpool and Holyhead steam-boats felt no shock.	Public papers of Dublin, and sundry private communications.
Suburbs of Dublin, Kingstown, Rathmines, Mountpleasant.				Phenomena similar to those felt in the city and parts immediately adjacent.	Evening Post correspondent. Sundry private communications. Private communications and Saunders' Newsletter November 11, 1852.
Bray, Delgany, Ballyboden, Rathfarnham, Wicklow, Arklow, Newtownmountkenedy,		Two heavy thumps with a continuous vibratory jar.	Delgany, 4 15. Bray, 4.	At Delgany a bunch of keys was shaken and rattled in a chamber candlestick, where they had been left. Sound generally described as continuing after the principal shocks. Phenomena generally as at Dublin.	Saunders' Newsletter, November 10.
Kilkenny,		Shaking for several seconds.	Arklow, a few minutes after 4. Arklow, 4 5. Castle Howard, 4 5.	Sleepers awakened; houses shook; a chimney-piece clock stopped at a place near Wicklow town, at 700 feet elevation over sea. The shock very severe at Castle Howard, described to have shaken to its foundation; it lies on a hill-side. Houses vibrated in an alarming manner; the oscillations were not thought to be accompanied by any noise.	Kilkenny Moderator, November 10, 1852.
Wexford,				A slight shock which shook the observer's house and bed, and those of his neighbours.	Correspondent of Saunders' Newsletter, November 12, 1852.

In the preceding columns the directions, where given, are those of true meridian. The times of shock (as in map) are Greenwich mean time in Great Britain (except as to Congleton); and in Ireland, assumed Dublin time. Most of the newspaper correspondence adopted was authenticated. The names of private correspondents are not in all cases given; and their information must be taken on the author's authority.

The more important points to arrive at in every earthquake, of course, are:—

1. The direction of emergence of the earth-wave of shock.
2. The moment of its emergence in time.
3. Its velocity of emergence.
4. The dimensions of the wave, or rather its altitude at each point of observed emergence.

In the present instance the observations collected afford but a very meagre basis even for approximate answers to any one of these inquiries, and such must ever be the case until self-registering seismometers are to be found in all our observatories, &c.

The following conclusions, however, are justifiable:—

1. The general direction of emergence of the earth-wave was from south to north, making a considerable vertical angle with the horizon, i. e. emerging upwards from the ground.

The following is some of the evidence that it had both a horizontal and a vertical component of motion. As regards horizontal direction (that which is commonly best observable, and popularly assumed to be the only element of direction), there is abundant testimony that it was from south to north, varying more or less to the eastward or westward. There is also the decisive evidence of the fall of a pocket telescope to the northward, which stood on end in a glass-case in Mr. Yeates' optician shop, in Grafton-street. Its fall *towards* the north does not invalidate the other evidence that the primary motion was from south to north; as there exist numerous observed cases of objects *disturbed* by the primary or forward movement of the earth-wave, and *thrown down* by its return movement. (See First Report on Earthquakes, Trans. Brit. Ass.)

As respects the vertical component, in addition to the testimony of many who *felt* an up and down movement, the conditions of fall of the picture in the author's premises, already noticed, afford conclusive evidence. The wall against which it hung ranged nearly east and west; a shock coming horizontally, or

nearly so, from the north towards the south could produce no effect but that of pressing it closer to the wall ; or, if from south to north, of causing it to swing outwards from the wall, like a pendulum, suspended from the rings. No motion (within the limits here in question) from east to west, horizontally, that is, in the plane of the wall, could affect it at all. The vertical element of motion is indispensable to account for its having fallen.

If this vertical motion had been one emerging upwards from north to south, unless the angle were almost perfectly vertical, its effect would be merely to increase a little the strain upon the points of support for the moment, and to cause the lower part of the picture to swing out from the wall. But if the direction of motion were diagonally upwards from south to north, the whole force due to the vertical component, less the friction of the picture against the wall, would be expended in straining the points of support, and that due to the horizontal component in throwing the picture bodily off from the face of the wall. The picture was actually found thrown forward about eighteen inches from the wall at the point where it was arrested in its descent, after a fall of about four feet. I conclude, therefore, that the actual direction of emergence of the wave in the city of Dublin was from south to north (with probably a few degrees westerly bearing), and upwards at an angle of from 25 to 30 degrees with the horizon. The following diagram may make this more intelligible.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 1. Plan of passage.

FIG. 2. Vertical section through BC, looking southwards.

FIG. 3. Vertical section through DE, looking westwards.

The dotted lines show the original position of the picture; the hard lines its position when found dislodged and wedged between the side-walls.

The general form of the area of sea and land shaken assumes on the map the form of a large irregular ellipse of small eccentricity. Were observations to the south-west of this region available, it is likely that it might enlarge the curve in that direction.* Within this space the point of maximum disturbance seems to have been at and about Shrewsbury, where more serious results of the shock were experienced than in any other quarter. A strong wall of thirty yards in length was there overthrown; and at Newton, not far distant, a wooden bridge over the Severn is said to have fallen; while the bells rang in Ellesmere church.

The circumstances both of direction and of centre of maximum surface disturbance, therefore, seem to point to the great volcanic focus of which the Azores, Portugal, and the Canary Islands, form the well-known centres of convulsion—as the region of the origin of the shock in the present case—the point from which the blow was delivered, which transmitted the elastic wave, would, on following the general direction to the south, pass through the group of the Canaries. And assuming that we have arrived with any tolerable approximation at the angle of emergence, the vertical depth of the origin, if taken below these islands, would be very great indeed. It is quite likely, however, that an intermediate point of convulsive energy exists in or about the latitude of Lisbon, and thus at a less profound depth.

It is worthy of remark that the circumstances of this shock, viz., the previous increasing tremor, accompanied by the “Bramidos,” the horrible subterranean thunder, and ending with the violent single or double shock, are precisely those of the terrible Lisbon earthquake of 1755, and of all others in that region.

The Portuguese focus was in energetic action about the precise time of our earthquake, as the following notice proves :—

“A shock of an earthquake had been felt at Malaga, which spread general consternation among the inhabitants of that city. At half-past 1 o'clock A.M.

* I have obtained no observations made at sea. Professor Haughton stated when the author's paper was read, that the shock had been felt at Clogheen, county of Tipperary; and the Rev. S. Smith, that it had been felt at Enniskillen. As these gentlemen, however, did not communicate their information at the proper time, the author has been unable to adopt it, or to know to what extent the evidence may be received.

strong oscillations shook all the edifices. The people immediately sallied out of their houses, and sought refuge at La Alameda and in the public squares. Fortunately, the shock was not renewed. The temperature was suffocating ; the cloudy aspect of the sky induced a belief that another earthquake would take place the following night. Many families accordingly retired on board the vessels in the harbour. The shock was preceded by a loud noise."—"Times" Newspaper, 10th November, 1852.

The date actually referred to will be the 7th or 8th of the month.

It may be remarked, that the basin of the Greek Archipelago appears to have been in activity a little before the same period, an earthquake having overthrown the magnificent columnar remains of the Temple of Jupiter Olympias at Athens. ("Times," 24th November, 1852.)

As respects the time of the shock, it appears to have been felt almost, if not altogether, simultaneously over the whole area shaken in Great Britain and in Ireland,—a circumstance in itself corroborating the evidence for the considerable angle at which it emerged, for shocks nearly horizontal are always observed to have a progressive translation over the shaken country.

There is no evidence of a sufficiently precise character to warrant any conclusions, either as to the velocity of emergence of the wave, or as to its altitude, i. e. the actual range of shaking produced at any point by the shock. Comparing the evidences of disturbance in Dublin and other places, with the effects of many other earthquakes, the author is disposed to attribute the safety from serious calamity fortunately experienced by us, in great measure, to the vertical element in the direction of the shock, which, with only the same velocity and range, had it been much more nearly horizontal, might probably have produced great disaster.

On examining the lines of horizontal direction for different localities as recorded on the map, they will be found to differ considerably. In this there is nothing unusual or irreconcilable with faithful observation or with science. Local changes in the true direction, and still more in the apparent or horizontal direction, of translation of the earth-wave are due to many causes, principally to changes in the geological formations at different points, or to the structure of the earth's crust, and to abrupt changes in the physical features of the surface of the country. Instances are not wanting of the same shock being felt in di-

rections almost opposite, at the same moment, in places not far apart, and this circumstance constitutes one of the difficulties of disentangling the true elements of almost every shock, and of the construction of seismometrical instruments.

Some very local points of greater disturbance were observed. Thus, at Castle Howard, in the Vale of Avoca, county of Wicklow, Ireland, the shock was experienced with great severity, due to the circumstances of its position. It stands upon a spur of mountain jutting out towards the westward from a north and south range. It rests on slate rocks, having a generally north and south strike, and its elevation on the hill is considerable. A shock from south to north would therefore affect it with exaggerated power. The shock was not felt at all by any one on board any of the steam-vessels passing either way between Liverpool or Holyhead and Dublin, on the night of the 9th November, nor was it felt by the printers up and at work in the several newspaper offices in Dublin, Liverpool, or Manchester. In all these cases the local vibrations going on by the machinery at work obviously prevented the earthquake jar being observed, or confounded it with those taking place from the local causes.

A few of the more remarkable secondary effects observed may be noticed. The flickering of the gas-lights in the streets of Dublin, observed by the writer from Christ-Church-place (see *ante*), occurring some minutes after the shock, was doubtless due to the depression of the gasometers at the gas-works into the tanks by the vertical direction of the shock, and by the surging of the water in the tanks themselves, the time that elapsed being that necessary to transmit such disturbance from the gasometers through the elastic fluids in the street mains, tubes, &c., to the lights.

Very many small birds, chiefly sparrows, were found dead upon the ground on the morning after the shock, as at the goods sheds of the King's-bridge Terminus, Great Southern and Western Railway, and in Mountjoy-square. This, which has been often observed in earthquake countries, is due to the creatures being shaken while asleep off their roosting-places, the involuntary muscles of the claws, which hold them on, not being prepared to resist so sudden and unexpected a shock.

Clocks were stopped in some places, unfortunately without the time of stopping being noted.

As the relations of earthquakes with meteorology are as yet uncertain, it appeared desirable to obtain returns on this subject from several stations within

the region of shock for the day of the earthquake, and for the one preceding and following. The results are given in the subjoined Table.

METEOROLOGICAL TABLE, *referring to the British Earthquake of November 9, 1852, for five principal Stations.*

INSTRUMENT.	DATE.	OBSERVING STATIONS.				
		Dublin.	Armagh, reduced to 50° Fahr. 9 A.M.	Sligo, Markree Castle, 10 o'clock A.M.	York, 9 o'clock A. M.	Greenwich means for the day.
Barometer, . {	Nov.					
	8,	29·820	29·504	29·712	29·848	29·976
	9,	30·116	29·994	30·105	30·208	30·025
	10,	30·044	29·933	30·002	30·104	29·915
Thermometer, {	8,	58°·5	57°·0	52°·9	55°·0	52°·8
	9,	59 ·0	48 ·2	48 ·7	48 ·0	51 ·5
	10,	52 ·0	43 ·2	44 ·9	40 ·0	40 ·3
Rain-gauge, {	Inches.	Inches.	Inches.	Inches.	Inches.	
	8,	0·	0·136	0·313	0·05	0·
	9,	0·280	0·036	0·063	0·05	0·
	10,	0·030	1·043	0·001	0·00	0·
Wind, . . . {			Miles, last 12 hours travelled.			
	8,	S. W.	251 S.	W. N. W.	S.	W.S.W.
	9,	S.	46 S. S. W.	S. E.	S. W.	W.-S.W.-W.S.W.
	10,	S. E.	25 E. N. E.	E. N. E.	S. W.	calm, N.E.-E.N.E.
						On the 11th Aurora, and magnets greatly disturbed.
NOTE.—The whole winter of 1852 was one of unusual wetness, followed in early spring by hard and protracted frosts, and was probably the most severe winter, on the whole, recorded for twenty or thirty years in the British Islands.						

These results confirm the view (so far provisionally) deducible from all earthquakes, namely, that meteorological phenomena have probably no true causative connexion with these disturbances, although they are often acted on and modified by the secondary effects due and subsequent to earthquakes.

There are good grounds for supposing that during the night of the 9th November, 1852, several minor shocks of earthquake took place, and were felt more or less in and around Dublin by different individuals, who, before the severe shock of 4 o'clock A.M., did not attribute them to any natural cause: and a letter to our fellow-member, Mr. Clibborn, from a trustworthy observer, renders it probable that on the succeeding night there was a continuance of subterranean commotion of a diminished character, and such, very probably, might have continued during the intervening day also, but without attracting the attention, which the *silence and increase of sound* at night induced.

The last shock of earthquake of any note occurring in Great Britain was experienced with various degrees of intensity throughout the greater part of Lancashire, and the adjacent districts of Westmoreland, Cumberland, Cheshire, Flintshire, and the Isle of Man, and took place a few minutes before 1 o'clock on the morning of Friday, March 17, 1843. On that occasion, as on the present, somewhat varying statements were made as to the duration and severity of the visitation, but there was a material difference in the state of the weather and of the atmosphere. After the last shock in 1843, accounts were received from the West Indies announcing that a severe earthquake had taken place there about the same time, and that a great number of lives had been sacrificed.

Of preceding British earthquakes, out of 116 recorded by Milne, 31 (according to him) had their centres in Wales, 31 along the south coast of England, 14 on the borders of Yorkshire and Derbyshire, and 5 or 6 in Cumberland.

In the south of England he is of opinion that most shocks have an E. and W. direction, while those of Anglesea, North Wales, and Cheshire are N. W. and S. E., in both cases coinciding with the general lines of great faults.

He considers, from the discussion of 130 Scottish and of 116 English earthquakes, that there is a maximum of occurrence for the former in November, and for the latter in September; taken all together, there occurred 74 in the three winter months, 44 in spring, 58 in summer, and 79 in autumn; or 50 in the summer half year against 89 in the winter half.

M. Perrey, in his Memoir on British earthquakes, from a discussion of 234

recorded, extending over a period of ten centuries, viz., from the ninth to the nineteenth, distributes them thus :—

Winter, ...	56
Spring, ...	42
Summer, ...	52
Autumn, ...	67

On the whole, whether it may ultimately appear that earthquakes have some distinct relations to season all over the globe, in Great Britain the base of induction is too small, and the numbers approach too near to equality, to warrant such conclusions at present.

M. Perrey has also classified the directions of shocks (horizontal or apparent directions only) of the preceding British earthquakes, as follows :—

S. to N., ...	0·48
N. E. to S. W., ...	0·48
E. to W., ...	1·70
S. E. to N. W., ...	0·73
S. to N., ...	3·73
S. W. to N. E., ...	1·46
W. to E., ...	1·46
N. W. to S. E., ...	0·97

If we unite those having the same direction, but merely opposite primary motions, we have,

North and South, ...	1·21
East and West, ...	3·16
Intermediate points to the Eastward of North, ...	1·94
Intermediate points to the Westward of North, ...	1·70

If this result be relied upon as on a sufficient basis, it would indicate that British earthquakes most frequently come from other and more distant centres of disturbance than that assignable to the shock here treated of.